Badger Meter Europa GmbH

MN05 / MN1 / MN2 with MR100

Oval gear meters

INSTRUCTION AND OPERATION MANUAL

January 2009

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1. Basic safety recommendations 1

2. Repairs 1

3. To the owner 2

4. Operation 2

5. For the use in ex-zones 2

6. Installation 3

7. General maintenance 3

8. Maintenance – pulse meters 4

8.1 Pulse meter disassembly 4

8.2 Pulse meter re-assembly 4

9. Maintenance – LCD meters (MXXXD-X & -XH) 5

9.1 LCD meter disassembly 5

9.2 LCD meter re-assembly 5

10. PCB maintenance 6

10.1 PCB removal 6

10.2 PCB replacement 6

11. Trouble shooting 7

12. Wetted materials 7

13. Sensor wiring details 8

14. Spare parts listing 8

15. Return of goods for repair / harmless declaration 11

16. Warranty 12

1. Basic safety recommendations

The manufacturer is not liable for damages that result from improper or not in accordance with the requirements use.
The meters are constructed according to state-of-the-art technology and tested operationally reliable. They have left the factory in a faultless condition concerning safety regulations.
The mounting, electric installation, taking into operation and maintenance of the meter may only be carried out by suitable technicians. Furthermore the operating personnel has to be trained by the operating authority and the instructions of this manual have to be followed.
Basically, you have to respect the regulations for the opening and repairing of electrical equipment valid in your country.

2. Repairs

If you should send back a flow meter in operation, please take notice of the following points:

- Please enclose a description of the error as well as a precise statement of the measured medium (if necessary a safety specification sheet).
- The meter has to be in a cleaned condition (outside and inside). Especially with harmful measuring mediums you have to pay attention that there are no impurities nor residues in the pipe or at the connections.
- If it is not possible to clean the meter completely, particularly with harmful materials, do not send back the meter.
- Please copy and fill in the harmless declaration at the end of this manual and send it back together with the meter to be repaired.

We reserve the right to repair only cleaned meters. Costs, which result from insufficient cleaning, will be charged to you.

3. To the owner

Thank you for purchasing a MN series flow meter. Please take a few minutes to read through this manual before installing and operating your meter. If you have any problems with the meter, refer to the maintenance and trouble shooting sections of this manual.

This manual contains connection and operating instructions for the MN4 series meters. If you need further assistance, contact us or your local representative for advice. The MN series flow meter has incorporated the oval rotor principle into its design. This has proven to be a reliable and highly accurate method of measuring flow. Exceptional repeatability and high accuracy over a wide range of fluid viscosities and flow rates are features of the MN series flow meter design. The low pressure drop and high pressure rating means the MN series flow meter is suitable for both gravity and pump (in-line) applications. **The meter is preferrably used for the measurement of lubricants. Other fluids on request.**

4. Operation

Please read this information carefully before use!

Before use, confirm the fluid to be used is compatible with the meter, or consult your local representative for advice. This meter will handle particle sizes up to 0.075 mm/0.0003”. To prevent damage from dirt or foreign matter, we recommend a Y or basket type 200 mesh strainer be installed as close as possible to the inlet side of the meter. To prevent damage to the meter slowly fill the system with fluid (this will prevent damage caused by air purge). Note: Failure to do this could damage the meter. For pump applications, turn off the pump at the end of each day.

5. For the use in ex-zones

- Reed switch: Connection to intrinsically safe electric circuit (simple electrical equipments must be operated intrinsically safe with a suitable barrier according to EN 50020).
- Equipotential bonding has to be ensured upon the pipe system.
- Meters with plastic housing (PPS): Please do not clean the meters with a dry cloth as this would cause electrostatic charge.
- The fluid conductivity must be better than 1000 pico/ Siemens/meter to avoid electrostatic charges.
- Ambient temperature must be between - 20°C and + 40°C (T4).
- If electronical register is mounted on the meter or operated with the meter, the electronical register must have a current ATEX approval and must be operated intrinsically safe with a suitable barrier according to EN 50020.

6. Installation

Please read this information carefully before use!

1. Always ensure that the fluid to be used is compatible with the meter. Refer to industry fluid compatibility charts or consult your local representative or distributor.

2. It is strongly recommended that a strainer be installed before the meter for every application. Meters damaged by particles in the fluid may not be covered by warranty. Refer to chapter 9 “Sensor wiring details” for recommended strainer size.

3. To prevent damage to the meter from entrapped air during initial commissioning or after maintenance, slowly fill the piping system with fluid before starting pumping systems.

4. Use a liquid thread sealant on pipe fittings.

5. Use flexible pipe connections to prevent meter strain.

6. Ensure the meter is mounted with the shafts in the horizontal plane.

7. Refer to chapter 9 for sensor wiring details.

8. Always select meters to operate around the middle of the specified flow rate.

9. Install a system pressure relief valve to prevent possible meter damage caused by thermal expansion.

7. General maintenance

Please read this information carefully before disassembly.

Cautions:
- Ensure the fluid is isolated from the meter to be repaired.
- Ensure the fluid line is depressurized before commencing disassembly.
- Ensure electrical wiring is isolated and disconnected before commencing repairs.

To prevent damage to the meter during re-commissioning, slowly fill the piping system with fluid before starting the pumping system. Refer to chapter 9 for sensor wiring details.

8. Maintenance – pulse meters

8.1 Pulse meter disassembly

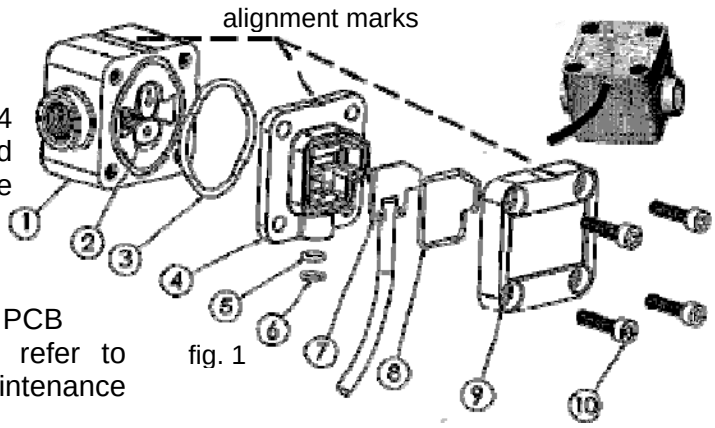

fig. 1

1. Loosen and remove 4 Phillips head or cap head screws (item 10). See figure 1.
2. Remove the meter cap (item 9) and o'ring (item 8).
3. Remove the inner plate and PCB assembly (items 4 to 7), refer to chapter 6 for PCB maintenance details.
4. Remove the o'ring (item 3).
5. Remove the rotors (item 2), note the position of the rotor with the magnet(s) or grub screws.
6. Clean and inspect all components, replace as necessary, see chapter 10 for spare parts listing.

8.2 Pulse meter re-assembly

1. Replace the rotors (item 2), see figure 2 or 3 for correct orientation. Rotate the rotors by hand to ensure correct engagement.
2. Fit the o'ring (item 3) into the o'ring groove in the meter body (item 1).
3. Fit the inner plate assembly (items 4 to 7), form the o'ring (item 8) into the inner plate (item 4), and fit the meter cap (item 9). Ensure all the alignment marks are lined up with the mark on the body, see figure 1.
4. Fit and tighten the 4 bolts (item 10) to the required torque. See chapter 11 for details.
5. Check meter function using low air pressure.
6. Restore the fluid and reconnect the wiring as detailed in chapters 2 and 9 respectively.

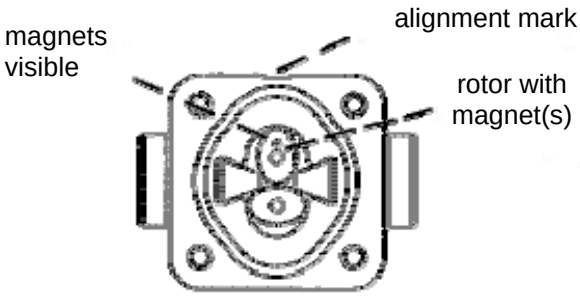

fig. 2 - MN05 meter

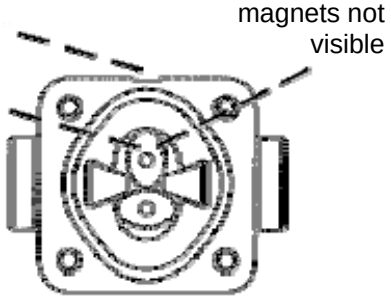

fig. 3 - MN1 & MN2 meter

9. Maintenance – LCD meters (MXXXD-X & -XH)

9.1 LCD meter disassembly

1. Remove the protective boot (item 15), see figure 4.
2. Using a 2mm allen key, loosen and unscrew, a few turns, the two grub screws located on each side of the register (item 13).
3. Carefully remove the register and disconnect sensor connector (item 7) from the rear of the register.
4. Loosen and remove 4 Phillips head or cap head screws (item 11).
5. Remove the o'ring (item 10) and adaptor plate (item 9).
6. Remove the o'ring (item 8). 3

7a. For models MXXXD-X, remove the PCB (item 7) and the inner plate assembly. (items 4 to 6)

7b. For models MXXXD-XH, remove the inner plate assembly (items 4 to 7)

8. Remove the o'ring (item 3).
9. Remove the rotors (item 2). Note the position of the rotor with the magnet(s).
10. Clean and inspect all components, replace as necessary. See chapter 10 for spare parts listing.

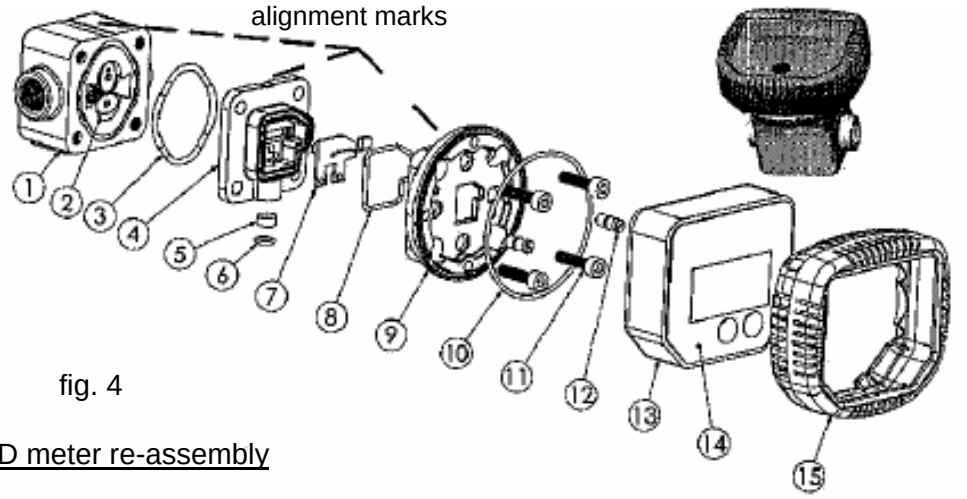

fig. 4

9.2 LCD meter re-assembly

1. Replace the rotors (item 2). See figure 2 or 3 for correct orientation.
2. Fit the o'ring (item 3) into the o'ring groove in the meter body (item 1). See figure 4.

3a. For models MXXXD-X, replace the inner plate and seal assembly (items 4 to 6) onto the meter body (item 1) and fit the PCB (item 7).

3b. For models MXXXD-XH, replace the inner plate, PCB and seal assembly (items 4 to 7).

4. Check the alignment marks, see figure 4, and form the o'ring (item 8) into the groove.
5. Pass the PCB cable (item 7) through the adaptor (item 9) and fit the adaptor, check the alignment marks. See figure 4.
6. Fit 4 screws (item 11) and tighten. See chapter 11 for torque specifications.
7. Fit the o'ring (item 10).
8. Connect the PCB cable to the 3 pin terminal on the rear of the register (item 13).
9. Locate the register (item 13) onto the connecting bollards (item 12) which are located on the adaptor unit (item 9). Ensure the PCB cable is not trapped between the adaptor (item 9) and the register (item 13).

10. PCB maintenance

10.1 PCB removal

1. The PCB contains components that are sensitive to static shock, ensure all items and maintenance staff are grounded before working on the PCB.
2. Using a thin blade, or similar, remove the wire clip (item 6) and seal (item 5) on MXXXPX, (see figure 1) and MXXXD-XH (see figure 2) models.
2. While lifting the PCB with the blade inserted near the inner plate alignment marks carefully push the cable into the inner plate, continue to lift the back of the PCB until all components on the PCB clear the inner plate.
3. Grasp the cable near the PCB and pull the cable through the opening in the inner plate until the cable ferrules are near the inner plate opening.
4. Push the cable ferrules into the PCB opening, one at a time and remove the cable.

10.2 PCB replacement

1. The PCB contains components that are sensitive to static shock, ensure all items and maintenance staff are grounded before working on the PCB.
2. Feed the cable ferrules, one at a time, through the cable opening in the inner plate.
3. Gently pull the cable through the inner plate opening until the PCB almost touches the inner plate.
4. While pulling the cable gently tilt the PCB into the recess in the inner plate, ensure components underneath the PCB do not come into contact with the inner plate.
5. Pull the cable until the cable ties contact the inner plate, gently push the PCB down into the housing.
6. Press the seal (item 5) into the inner plate cable entry, followed by the wire clip (item 6), ensure they are both seated correctly.

11. Trouble shooting

Trouble shooting guide		
Trouble	**Cause**	**Remedy**
No flow through the meter	a) Foreign matter blocking rotors	a) Dismantle meter and clean rotors. Strainer must be fitted to main-tain warranty
	b) Line strainer blocked	b) Clean strainer
	c) Damaged rotors	c) Replace rotors. Strainer must be fitted to maintain warranty.
	d) Meter connections over tightened	d) Adjust connections
Reduced meter flow	a) Line strainer partially blocked	a) Clean strainer
	b) Fluid is too viscous	b) See specifications for maximum fluid viscosity
Reading inaccurate	a) Fluid flowrate is to high or too low	a) See specifications for flow rate range
	b) Air in fluid	b) Bleed air from system
	c) Wear caused by incorrect installation	c) Correct installation, see chapter 2
No pulse signal	a) Faulty POB	a) Replace PCB
	b) Faulty magnets	b) Replace rotors
	c) Rotors incorrectly installed afer maintenance	c) Refer to chapter 4 or 5 for correct installation

12. Wetted materials

Component	Models	Wetted materials
Body		
	MN05 / MN1 / MN2	316L Stainless steal
	MN05 / MN1 / MN2	Aluminium
	MN1 / MN2	PPS
Shafts		
	MN05 / MN1 / MN2	Stainless steal
	MN1 / MN2	Hastelloy (optional)
Rotors		
	MN05 / MN1 / MN2	PM Stainless steal
	MN1 / MN2	PPS
Bush		
	MN1 / MN2	Zirconia
	MN05	Sapphire
Inner plate / meter cap		
	MN05 / MN1 / MN2	316L Stainless steal
	MN05 / MN1 / MN2	PPS
Magnet		
	MN05 / MN1 / MN2	Samarium cobalt

13. Sensor wiring details

Red wire	On BC2 = 6	Hall sensor power (+)	Hall voltage range	4,5 – 24V DC
Black wire	On BC2 = 5	Hall sensor negative (-)	Hall max rated current	25mA
White wire	On BC2 = 4	Hall sensor signal	Hall connection	1K ohm pull up resistor fitted
Yellow wire		Reed sensor connection	Reed max voltage	30V
Green wire		Reed sensor connection	Reed max current	0,5A
			Reed life (typical)	500 x 10^6 cycles 10VDC at 10mA

14. Spare parts listing

Common flow meter parts		**MN05**			
Item	**Description**	**M05AXX-X**	**M05SXX-X**	**M05SXXI-X**	**M1AXX-X**
1	Meter body & shafts BSP	MS605BS	MS600BS	MS600BS	MS1AL-1S
1	Meter body & shafts NPT	MS605NS	MS600NS	MS600NS	MS1AL-2S
1	Meter body & Hast. shafts-BSP	N/A	N/A	N/A	N/A
1	Meter body & Hast. shafts-NPT	N/A	N/A	N/A	N/A
2	Rotor assy. (Ind.mat.ref)	MS810S(SS)	MS810S(SS)	MS810S(SS)	MS810S(SS)
2	Rotor assy. (Ind.mat.ref)	N/A	N/A	N/A	N/A
2	Rotor assy. – double pulse	N/A	N/A	N/A	N/A
2	Rotor assy. – high visc.	N/A	N/A	N/A	N/A
3	O-ring – Viton	BS029VS	BS029VS	BS029VS	BS029VS
3	O-ring – Nitrile	BS029S	BS029S	BS029S	BS029S
3	O-ring – EPDM	BS029ES	BS029ES	BS029ES	BS029ES
3	O-ring – Perfluroelastomer	BS029TES	BS029TES	BS029TES	BS029TES
4	Inner plate	MS427S	MS427-1S	MS427-1S	MS427S

Common flow meter parts		**MN1**			
Item	**Description**	**M1RXX-X**	**M1SXX-X**	**M1SXXI-X**	**M2AXX-X**
1	Meter body & shafts BSP	MS1R-1S	MS1S-1S	MS1S-1S	MS2AL-1S
1	Meter body & shafts NPT	MS1R-2S	MS1S-2S	MS1S-2S	MS2AL-2S
1	Meter body & Hast. shafts-BSP	MS1R-1C	N/A	N/A	N/A
1	Meter body & Hast. shafts-NPT	MS1R-2C	N/A	N/A	N/A
2	Rotor assy. (Ind.mat.ref)	MS811S(PPS)	MS812S(SS)	MS812S(SS)	MS810S(SS)
2	Rotor assy. (Ind.mat.ref)	MS812S(SS)	MS811S(PPS)	MS811S(PPS)	N/A
2	Rotor assy. – double pulse	N/A	MS812DPS	MS812DPS	N/A
2	Rotor assy. – high visc.	N/A	N/A	N/A	N/A
3	O-ring – Viton	BS029VS	BS029VS	BS029VS	BS029VS
3	O-ring – Nitrile	BS029S	BS029S	BS029S	BS029S
3	O-ring – EPDM	BS029ES	BS029ES	BS029ES	BS029ES
3	O-ring – Perfluroelastomer	BS029TES	BS029TES	BS029TES	BS029TES
4	Inner plate	MS427S	MS427-1S	MS427-1S	MS427S

Common flow meter parts		MN2		
Item	**Description**	**M2RXX-X**	**M2SXX-X**	**M2SXXI-X**
1	Meter body & shafts BSP	MS2R-1S	MS2S-1S	MS2S-1S
1	Meter body & shafts NPT	MS2R-2S	MS2S-2S	MS2S-2S
1	Meter body & Hast. shafts-BSP	MS2R-1C	N/A	N/A
1	Meter body & Hast. shafts-NPT	MS2R-2C	N/A	N/A
2	Rotor assy. (Ind.mat.ref)	MS813S(PPS)	MS814S(SS)	MS814S(SS)
2	Rotor assy. (Ind.mat.ref)	MS814S(SS)	MS813S(PPS)	MS813S(PPS)
2	Rotor assy. – double pulse	N/A	N/A	N/A
2	Rotor assy. – high visc.	N/A	MS814HS	MS814HS
3	O-ring – Viton	BS029VS	BS029VS	BS029VS
3	O-ring – Nitrile	BS029S	BS029S	BS029S
3	O-ring – EPDM	BS029ES	BS029ES	BS029ES
3	O-ring – Perfluroelastomer	BS029TES	BS029TES	BS029TES
4	Inner plate	MS427S	MS427-1S	MS427-1S

Spare parts MXXXP-X, see Rg1		MN05			
Item	**Description**	**M05AXX-X**	**M05SXX-X**	**M05SXXI-X**	**M1AXX-X**
5	O-ring (NBR)	N359S	N359S	N359S	N359S
6	Wire clip	N359S	N359S	N359S	N359S
7	PCB assembly	MS271AS	MS271AS	MS271AS	MS271AS
8	O-ring (NBR)	N359S	N359S	N359S	N359S
9	Meter cap	MS428S	MS428-1S	MS428-1S	MS428S
10	Fixing screws	MS98S	MS113S	MS277S	MS98S

Spare parts MXXXP-X, see Rg1		MN1			
Item	**Description**	**M1RXX-X**	**M1SXX-X**	**M1SXXI-X**	**M2AXX-X**
5	O-ring (NBR)	N359S	N359S	N359S	N359S
6	Wire clip	N359S	N359S	N359S	N359S
7	PCB assembly	MS271AS	MS271AS	MS271AS	MS271AS
8	O-ring (NBR)	N359S	N359S	N359S	N359S
9	Meter cap	MS428S	MS428-1S	MS428-1S	MS428S
10	Fixing screws	MS98S	MS113S	MS277S	MS98S

Spare parts MXXXP-X, see Rg1		MN2		
Item	**Description**	**M2RXX-X**	**M2SXX-X**	**M2SXXI-X**
5	O-ring (NBR)	N359S	N359S	N359S
6	Wire clip	N359S	N359S	N359S
7	PCB assembly	MS271AS	MS271AS	MS271AS
8	O-ring (NBR)	N359S	N359S	N359S
9	Meter cap	MS428S	MS428-1S	MS428-1S
10	Fixing screws	MS98S	MS113S	MS277S

Spare parts MXXXD-X, see Rg4		MN05			
Item	**Description**	**M05AXX-X**	**M05SXX-X**	**M05SXXI-X**	**M1AXX-X**
5	Plug (NBR)	N359S	N359S	N359S	N359S
6	Wire clip	N359S	N359S	N359S	N359S
7	PCB assembly	MS271A-MRS	MS271A-MRS	MS271A-MRS	MS271A-MRS
8	O-ring (NBR)	N359S	N359S	N359S	N359S
9	Adaptor	MS786S	MS786S	MS786S	MS786S
10	O-ring (NBR)	BS037S	BS037S	BS037S	BS037S
11	Fixing screws	MS98S	MS98S	MS98S	MS98S
12	Bollards	MR017S	MR017S	MR017S	MR017S
13	Register assembly	MR100AS	MR100AS	MR100AS	MR100AS
14	Facia decal	MR019S	MR019S	MR019S	MR019S
15	Protective boot	IM071BUS	IM071BUS	IM071BUS	IM071BUS

Spare parts MXXXD-X, see Rg4		MN1			
Item	**Description**	**M1RXX-X**	**M1SXX-X**	**M1SXXI-X**	**M2AXX-X**
5	Plug (NBR)	N359S	N359S	N359S	N359S
6	Wire clip	N359S	N359S	N359S	N359S
7	PCB assembly	MS271A-MRS	MS271A-MRS	MS271A-MRS	MS271A-MRS
8	O-ring (NBR)	N359S	N359S	N359S	N359S
9	Adaptor	MS786S	MS786S	MS786S	MS786S
10	O-ring (NBR)	BS037S	BS037S	BS037S	BS037S
11	Fixing screws	MS98S	MS98S	MS98S	MS98S
12	Bollards	MR017S	MR017S	MR017S	MR017S
13	Register assembly	MR100AS	MR100AS	MR100AS	MR100AS
14	Facia decal	MR019S	MR019S	MR019S	MR019S
15	Protective boot	IM071BUS	IM071BUS	IM071BUS	IM071BUS

Spare parts MXXXD-X, see Rg4		MN2		
Item	**Description**	**M2RXX-X**	**M2SXX-X**	**M2SXXI-X**
5	Plug (NBR)	N359S	N359S	N359S
6	Wire clip	N359S	N359S	N359S
7	PCB assembly	MS271A-MRS	MS271A-MRS	MS271A-MRS
8	O-ring (NBR)	N359S	N359S	N359S
9	Adaptor	MS786S	MS786S	MS786S
10	O-ring (NBR)	BS037S	BS037S	BS037S
11	Fixing screws	MS98S	MS98S	MS98S
12	Bollards	MR017S	MR017S	MR017S
13	Register assembly	MR100AS	MR100AS	MR100AS
14	Facia decal	MR019S	MR019S	MR019S
15	Protective boot	IM071BUS	IM071BUS	IM071BUS

Spare parts MXXXD-X, see Rg4		MN2		
Item	**Description**	**M2RXX-X**	**M2SXX-X**	**M2SXXI-X**
5	Plug (NBR)	N359S	N359S	N359S
6	Wire clip	N359S	N359S	N359S
7	PCB assembly	MS271A-MRS	MS271A-MRS	MS271A-MRS
8	O-ring (NBR)	N359S	N359S	N359S
9	Adaptor	MS786S	MS786S	MS786S
10	O-ring (NBR)	BS037S	BS037S	BS037S
11	Fixing screws	MS98S	MS98S	MS98S
12	Bollards	MR017S	MR017S	MR017S
13	Register assembly	MR100AS	MR100AS	MR100AS
14	Facia decal	MR019S	MR019S	MR019S
15	Protective boot	IM071BUS	IM071BUS	IM071BUS

Spare parts MXXXD-XH, see Rg4		MN05			
Item	**Description**	**M05AXX-X**	**M05SXX-X**	**M05SXXI-X**	**M1AXX-X**
7	PCB assembly	MS271A-MRHS	MS271A-MRHS	MS271A-MRHS	MS271A-MRHS

Spare parts MXXXD-XH, see Rg4		MN1			
Item	**Description**	**M1RXX-X**	**M1SXX-X**	**M1SXXI-X**	**M2AXX-X**
7	PCB assembly	MS271A-MRHS	MS271A-MRHS	MS271A-MRHS	MS271A-MRHS

Spare parts MXXXD-XH, see Rg4		MN2		
Item	**Description**	**M2RXX-X**	**M2SXX-X**	**M2SXXI-X**
7	PCB assembly	MS271A-MRHS	MS271A-MRHS	MS271A-MRHS

15. Return of goods for repair / harmless declaration

Please copy, fill in and sign hereafter harmlessness declaration and enclose it for any return of goods you may send back for repair.

No repair will be performed prior to receiving the harmlessness declaration duly filled and signed.

Harmless declaration

To : _____

Attn. : _____

From : _____

Dept. : _____

Please note that no repair will be performed prior to receiving of this declaration duly singed by you!

Please send all parts clean from medium and inform us about possible medium wastes remaining in the part. For this purpose, please use this form. A security specification sheet of the medium must accompany this declaration in the following cases: Toxical, dangerous or objectionable media, or media beloning to any dangerous materials class. We inform you that uncleaned parts lead to additional costs. Extra clean costs will be charged to you. Furthermore, we reserve us the right to send the parts back to you for cleaning!

Declaration

We herewith confirm that the part(s) sent for repair has/have been cleaned and is/are free of any liquid and/or solid wastes of the medium and/or cleaning medium: Any eventually remaining wastes are:

❍ harmless

❍ dangerous, toxic, etc. – Security specifications are attached

Signature of person in charge: _____

Name of the person in charge in capital letters: _____

Date: _____

Company stamp: _____

16. Warranty

Badger Meter warrants meters and parts manufactured and supplied by it hereunder to be free from defects in materials and workmanship for a period of 18 months from date of shipment or 12 months from date of installation, whichever period shall be shorter. If within such period any meters or parts shall be proved to seller´s satisfaction to be defective, such meters or parts shall be repaired or replaced at seller´s option. seller´s obligation hereunder shall be limited to such repair and replacement and shall be conditioned upon seller´s receiving written notice of any alleged defect within 10 days after its discovery and, at seller´s option, return of such meters or parts to seller, f.o.b. its factory. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES WHATSOEVER INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES (EXCEPT OF TITLE) OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Badger Meter shall not be liable for any defects attributable to acts or omissions of others after shipment, nor any consequential, incidental or contingent damage whatsoever.

Note:
This warranty does not form part of, nor does it constitute, a contract between Badger Meter and the end user. It is additional to any warranty given by the seller of the products and does not exclude, limit, restrict or modify the rights and remedies conferred upon the end user, or the liabilities imposed on the seller, by any statute or other laws in respect of the sale of the product.

Hotline

Tel. +49-7025-9208-0 or -31
Fax +49-7025-9208-15

Badger Meter Europa GmbH
Subsidiary of Badger Meter, Inc., USA

Nürtinger Strasse 76
72639 Neuffen (Germany)
E-mail: badger@badgermeter.de
www.badgermeter.de